

**Supplemental Specification
2005 Standard Specification Book**

SECTION 02645

**PRECAST CONCRETE BOX AND THREE-SIDED CULVERT
STRUCTURES**

Delete Section 02645 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Material and procedures for fabricating and installing single cell precast concrete box culverts and precast conventionally reinforced concrete three-sided culvert structures.

1.2 RELATED SECTIONS

- A. Section 02056: Common Fill
- B. Section 02317: Structural Excavation
- C. Section 02324: Compaction
- D. Section 03055: Portland Cement Concrete
- E. Section 03211: Reinforcing Steel and Welded Wire
- F. Section 03310: Structural Concrete
- G. Section 03390: Concrete Curing

1.3 REFERENCES

- A. AASHTO M 198: Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

- B. AASHTO LRFD Bridge Design Specifications
- C. ASTM C 877: Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
- D. ASTM C 1433: Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
- E. ASTM C 1504: Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts and Storm Drains
- F. UDOT Quality Management Plan

1.4 SUBMITTALS

- A. Shop Drawings: Furnish to the Engineer.
 - 1. Shop drawings: Five half-size 11 inch by 17 inch sheets with a 1½ inch blank margin on the left-hand edge.
 - 2. Design calculations for Precast Concrete Three-Sided Structures signed and stamped by a Utah Professional Engineer (PE).
 - 3. Place the State project designation data in the lower right-hand corner of each sheet.
 - 4. Prepare shop drawings under stamp of a Utah PE.
- B. Department rejects units fabricated prior to written approval.

1.5 ACCEPTANCE

- A. Precast concrete box culverts and three-sided structures may be accepted at a reduced price when the concrete strength is below that specified.
 - 1. Price adjustment pay factor following Section 03310.

PART 2 PRODUCTS

2.1 CONCRETE

- A. Wet Cast Concrete: Class 3A(AE). Follow Section 03055.
- B. Dry Cast Concrete:
 - 1. Minimum cement content: 470 lb/yd³ of concrete
 - 2. Maximum water/cement ratio: 0.40

3. Mix design:

Submit for approval

2.2 REINFORCING STEEL AND WELDED WIRE

A. Coated. Refer to Section 03211.

2.3 JOINT SEALANT

A. Meet AASHTO M 198.

B. Use a flexible butyl-blend material with a minimum cross-section of 1 ½ square inches as a joint sealant for box culverts.

C. Maintain the joint material at 70 degrees F or greater during placement.

2.4 JOINT WRAP

A. Refer to ASTM C 877.

2.5 QUALITY ASSURANCE

A. Department pre-qualifies pre-cast concrete box and three-sided culvert section manufacturers in accordance with the UDOT Quality Management Plan: Pre-cast/Prestressed Concrete Structures.

B. Permanently mark each precast unit with date of casting and supplier identification. Stamp markings in fresh concrete.

C. Prevent cracking or damage during handling and storage of precast units.

D. Replace cracked or damaged precast units at no additional cost to the Department.

PART 3 EXECUTION

3.1 MANUFACTURE

A. Precast Concrete Box Culverts:

1. Meet ASTM C 1433.

2. Multiply steel reinforcement requirements shown in table by 1.25, unless designed for HS-25 or greater loading.

3. Provide minimum reinforcing steel spacing 4 inches around circumference and 8 inches longitudinal.
 4. Provide 1 inch minimum concrete cover to reinforcing steel for box sections covered with 2 feet of fill or greater.
 5. Provide 2 inch minimum concrete cover to all reinforcing steel for box sections covered with less than 2 feet of fill.
- B. Precast Concrete Three-Sided Structures:
1. Meet requirements in ASTM C 1504 with the following exceptions:
 - a. Design structure in compliance with AASHTO LRFD Bridge Design Specifications, Section 12.14.
 - b. Design for HL-93 live loading.
 2. Provide minimum reinforcing steel spacing of 4 inches around circumference and 8 inches longitudinal.
 3. Provide 1 inch minimum concrete cover to reinforcing steel for three-sided sections covered with 2 feet of fill or greater.
 4. Provide 2 inch minimum concrete cover to all reinforcing steel for three-sided sections covered with less than 2 feet of fill.
- C. Portland Cement Concrete: Follow Section 03055.
- D. Concrete Curing: Follow Section 03390.

3.2 PREPARATION

- A. Excavating, Trenching, Bedding, and Backfill:
1. Refer to Section 02317.

3.3 BEDDING AND BACKFILL

- A. Over-excavate the material under the box location in compliance with Section 02317 to a minimum depth of 4 inches.
1. Replace over-excavated material with granular backfill borrow as specified in Section 02056.
 2. Provide a minimum bedding of 4 inches of granular backfill borrow.
- B. Level and compact bedding material to provide uniform support of the structure along its entire supported width and length.
- C. Use a loose sand leveling course no greater than 2 inch in depth if needed in addition to the granular backfill borrow bedding.
1. If loose sand is added, excavate the area to the appropriate depth to accommodate the backfill and leveling course.

- D. Backfill structure with granular backfill borrow as specified in Section 02056.
- E. Compact following Section 02324.
- F. Refer to project plans for excavation, bedding, and backfill requirements where a three-sided culvert structure is placed on a footing.

3.4 INSTALLATION

- A. Inspect precast elements for defects before lowering into trench.
- B. Repair or replace any defective, damaged or unsound precast elements.
- C. Use a trench width adequate to place and compact bedding material. Minimum outside width of trench is the outside width of structure plus 2 feet.
- D. Lay precast elements starting at the downstream end.
- E. Carefully lower precast elements into the trench with suitable equipment to prevent damage.
- F. Remove all dirt and foreign material from joints. Prevent dirt and material from re-entering joints.
- G. Apply joint sealant furnished by culvert manufacturer to box culvert.
 - 1. Place the joint material on the bottom half of the groove (bell) of the box last placed.
 - 2. Place the balance of the joint material on the top half of the tongue (spigot) of the box to be set.
 - 3. Place the material about 1 inch from the leading edge of the groove and tongue.
- H. Disassemble joint, check position of joint sealant, repair alignment, and re-install when adjoining elements cannot be pulled together to meet minimum joint requirements.
- I. Close the joints tightly.
- J. Do not disturb previously completed joints during laying operation.
- K. Do not lay precast elements when water is in the trench.
- L. Clean top and sides of concrete surface at joints before placing joint wrap.

- M. Use appropriate pulling devices to avoid misalignment and damage to box sections.
- N. Place three-sided structure sections against previous sections as tightly as possible, while maintaining alignment.
 - 1. Do not exceed joint tolerances in the stamped drawings.

3.5 STEEL REINFORCEMENT

- A. Follow Section 03211.

3.6 JOINTS

- A. Make joint opening between box sections less than 1 inch measured face to face of adjoining concrete surfaces.
 - 1. Reject box sections when the installation tolerance cannot be met due to casting variations.
 - 2. Prevent soil from being forced into the joint as the box sections are placed.
- B. Provide shear transfer devices for box culvert sections with less than 2 feet of cover.
 - 1. Device or method must be capable of transferring a minimum shear load of 3,000 lbs/ft of joint width through top slab of adjacent units.
 - 2. When using individual devices, space closer than 2.5 ft center to center with a minimum of two per joint.
- C. Mechanically connect the exterior segments of three-sided precast concrete structures at all top joints within a minimum length of 12 feet from each end of the structure.
 - 1. Use a minimum of four mechanical connections per joint with a maximum spacing of 10 feet.
 - 2. Galvanize all plates, shapes and hardware.
- D. Connect three-sided precast concrete structures to the footing/pedestal 2 feet from the outermost exterior edge of the structure at all four corners with a galvanized rigid mechanical connection.
 - 1. Locate the connection on the interior face of the segment to allow for future inspection.

3.7 LIFTING HOLES

- A. Provide a maximum of four lifting holes in the top slab, each having a maximum diameter of 3 inches.
- B. Locate holes to avoid interference with the reinforcing steel.
- C. Plug lift holes and lift insert recesses with a 1/1 sand to cement grout. Finish flush with all concrete surfaces.

3.8 CONNECTION TO CAST-IN-PLACE CONCRETE

- A. Where precast box sections join cast-in-place concrete, project the reinforcing steel a minimum of 12 inches out of the precast box section and square off the concrete face.

3.9 REPAIRS

- A. Box sections may be repaired as allowed in the referenced specification only when approved in advance by the Engineer.
- B. Making repairs in advance of approval will be cause for rejection.

3.10 MINIMUM LENGTH

- A. Do not use pre-cast segments less than 5 foot in lay length.

END OF SECTION